CHAPTER I

INTRODUCTION

1.1 Background of the Study

Population growth and accompanying economic development have meant that civil engineering projects are increasingly being carried out in mountainous regions in tropical countries. Wesley (1994) found that probably highway construction is the most important among those hilly development, however hydroelectric construction, geothermal power plants, and recreational resorts also constitute major projects.

Over the last decade, we have had numerous landslides culminating in tragedies and it is no coincidence that they all happened in hilly regions. The fact is, slopes are inherently unstable. While erosion in the form of soil run-offs occurs daily, slopes can collapse and result in destructive landslides.

Slope failures increase when a naturally occurring weak zone or what is called a "fault plane" in geological terminology is present. Landslides on November 20, 2002 at Taman Hillview, Ampang, occurred in such a high-risk zone. Actually, this kind of tragedy is not a new story in our country for instance the infamous Highland Tower Tragedy that happened in 1993 which is just at the side of the tragedy that happened.

Landslides and other gravity-stimulated mass movements are important and costly problem, and they are a continual source of concern for geotechnical engineers and engineering geologists throughout the world, particularly in geologically 'active' regions. They occur worldwide and are described as sudden, short-lived geomorphic events that involve the rapid-to-slow descent of soil or rock in sloping terrains. They can occur on any terrain given the right conditions of soil, moisture and the angle of slope.

Risks of landslides are enhanced in the tropics, where thick, loose residual soil, the result of deep weathering, can be easily eroded. Until and unless a holistic stance in tackling landslides is taken, lives and properties will be at stake and taxpayers' money will be wasted on rescue missions.

Although many mitigation works had been planned and designed prior to the construction of the project, there still exist many uncertainties associated with the material, spanning from its complex origin. Hence, its come the importance to analyze the stability of the existing slope. However, most of the times it is too costly or impossible to monitor the slope for the whole of its service life.

1.2 Problem Statement

There are many circumstances in slopes, where the civil engineer must investigate the stability of slope by performing slope stability analysis. Over the years, much research work had been carried out by researchers namely, Wu and Kraft (1970), Cornell (1971), Alonzo (1976), Tang et al. (1976), and Vanamrcke (1977), regarding the reliability analyses of slopes. They found that the uncertainties occur due to the variability of soil properties, systematic errors or model errors in measurement of properties, and model errors in analytical methods (Oka & Wu, 1990). It should be noted that all calculations for their work were made for the critical slip surface. The search for the critical failure surface, carried out over a number of admissible slip surfaces, is by and large still performed by repeated trials or by the grid search method (Nguyen, 1985).

Existing methods of slope stability analysis using slices (Bishop 1955, Janbu 1957) are based on the limit equilibrium theorem. An implicit assumption in equilibrium analyses of slope stability is that the stress-strain behaviour of the soil is ductile, i.e., that the soil does not have a brittle stress-strain curve (where the shearing resistance drops off after reaching a peak). This limitation results from the fact that the methods provide neither information regarding the magnitudes of the strains within the slope, nor any indication about how they may vary along the slip surface (Duncan, 1996). Besides it, the analysis only considered force and moment acting on the slices with total disregard to the deformation developed in the slices. Thus, it is not possible to obtain reliable results from the analyses if solely based on the method of slices (Terado et al., 1999).

Thus, in order to obtain a unique solution it is necessary to introduce extra conditions. Better analysis should therefore take into account the displacement and deformation of the slices, and also the stresses in the soil mass in determining the stability of slope. However, the problem arises in incorporating these extra conditions in the conventional slope stability analysis.

In the other hand, the stability analyses are performed not only to provide a factor of safety once the soil properties are known, but also to establish field shear strengths from the study of failures. It is rational to carry out the study determining what actually happened after an unexpected instability has occurred. It is therefore necessary to do some analyses in reverse, which is usually termed as "back analysis". The investigation is not mean to blame who or whom should be responsive to the failure but it collects valuable information that could be used in designing the remedial works as well as guidelines for further projects. The awareness of importance of back analysis has resulted in development of various methods in back analysis. However, the problem always arises in determining the suitable method of analysis and the way back analysis can be carried out.

1.3 Objective and Scope of the Study

The objective of this study is to determine the stability of the slope before and after the construction of *Bangunan Tambahan Fakulti Kejuruteraan Mekanikal, UTM.*

Stability analysis of slope is carried out based on the computer modelling using PLAXIS V7.2 (professional edition), a finite element package. A real case study of slope failure was chosen in fulfilling the objective of the study. Shear strength reduction technique is chosen for the determination of safety factor for its formulation based on finite element. The critical failure surface is found automatically. The values of shear strength parameters (c, ϕ) at failure along the failure plane are back calculated with the factor of safety is assumed to be unity.

The analysis is based on long-term condition. Drained analysis is used in this simulation modelling. For the simplicity of the analysis, unsaturated soil condition is out of the scope of study. Stresses of the soil mass along the critical slip surfaces as well as the displacement and deformation are determined using the theory of finite element.